# Project Summary

CONVENTIONAL CONCRETE DAMS
(Dynamic Nonlinear Analysis Methods for Concrete Dams)

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Purpose: To develop experimentally verified finite-element computer capabilities for the evaluation of the comprehensive nonlinear earthquake response of conventionally placed or roller compacted concrete dams (comprising both gravity and arch dams) under multi-component earthquake excitation.

Background: Various analytical procedures are available to compute the dynamic response of conventional concrete dams to earthquakes. The existing computer codes do not account for nonlinear stress-strain response or cracking within the mass concrete during earthquake shaking. The lack of these significant features would force the Corps to take design and/or remediation decisions that are not based on a more accurate representation of the system, and it could result in large unnecessary costs. The potential savings that this research work could generate for the U. S. Army Corps of Engineers can be visualized by considering the economic magnitude of any typical seismic remediation problem.

Experimental/Analytical Results: The development of EQTIME2D, a computer program for 2D linear and nonlinear analysis of concrete dams, has been primarily completed. This is a program with several alternative analysis options for static, eigenvalue and dynamic problems. Numerical simulations have been performed to validate the performance of the program in its multiple analysis features. New features are currently being incorporated into the code to improve its stability and convergence characteristics. In addition, a preprocessor module (EQTIMEpre) is under development as an additional tool to help the user with data input and model definition. The results from the shake table tests recently performed on a 1/20 scale model of Koyna Dam will be used in the validation of the program. These tests, which provided an unprecedented amount of data, were conducted at the Construction Engineering Research Laboratory in Champaign, IL.
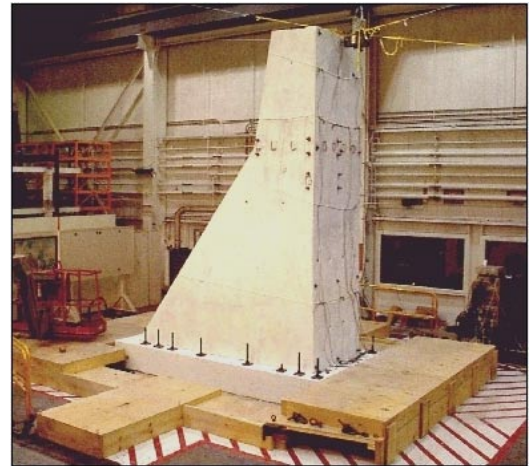
1/20 Scale Model of Koyna Dam

Final Product: Development of engineering tools for the assessment of the ultimate capacity of conventionally placed or roller compacted concrete dams. These tools will allow more realistic estimations of actual safety factors for concrete dam systems subjected to earthquake excitation.